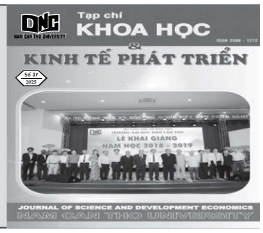
Journal of Science and Development Economics
Nam Can Tho University

Website: jsde.nctu.edu.vn



Promoting green logistics development in Can Tho City in the context of Industrial Revolution 4.0

Tran Thanh Huy[1], Truong Thi Kim[1], Nguyen Thi Ngoc Tran[1], Tran Thao Tran[1], Le Danh Dong[1], Nguyen Van Dinh[1*]

[1]*Nam Can Tho University*

[*]*Corresponding author: Nguyen Van Dinh (email: nvdinh@nctu.edu.vn)*

DOI: 10.64632/jsde.37.2025.612

Received: 15/6/2025
Revised: 18/7/2025
Accepted: 15/8/2025

Keywords: *Can Tho, supply chain, green logistics*

ABSTRACT

Green logistics development is not only a global trend to address environmental issues alongside economic development goals but also aims for sustainable development and environmental protection. Therefore, Can Tho City, as the central hub of the Mekong Delta region, needs to take the lead in developing green logistics towards sustainable development goals. To address this issue, Can Tho City needs to implement the following comprehensive solutions: developing green infrastructure, greening transportation activities, applying Industry 4.0 technologies in logistics, greening warehousing activities, greening reverse logistics activities, and greening logistics activities within enterprises.

1. INTRODUCTION

Logistics not only involves large investment costs but also strongly impacts product prices (on average, accounting for about 5% of GDP and 20% of the final price of goods). Logistics service providers can act as architects creating further development in the Fourth Industrial Revolution (Delfmann et al., 2018). Logistics development has contributed significantly to GDP, and with the current development rate of the logistics industry at 12-14% per year, it is estimated that by 2025, the logistics sector will contribute 8-10% of GDP (Ministry of Industry and Trade of Vietnam, 2021. The Industrial Revolution (IR) 4.0 will also strongly impact the Logistics Service industry in general and new logistics technologies in particular, thereby affecting the business model of logistics service providers, moving towards scientific and innovative approaches. However, this high growth rate also raises concerns about environmental pollution caused by logistics activities (Xiu & Chen, 2012. Environmental pollution and food safety issues, in general, are related to logistics activities at all stages from exploitation, raw material supply, energy, packaging, storage, warehousing to

distribution, transportation, etc. Therefore, green logistics development is considered an effective mechanism to address environmental issues in the global value chain, helping to minimize pollution and protect public health. Green logistics limits environmental damage and makes the best use of logistics resources (Beškovnik & Jakomin, 2010). According to Facts and Factors, the global green logistics market is expected to grow at a CAGR of 6.10%, reaching over 1481.5 billion USD by 2028 (Thanh Thu, 2022. Therefore, advancing green development in all sectors, including logistics, is an inevitable trend.

Can Tho City plays an important role in the development of the logistics network in the Mekong Delta. The entire region has 32 port berths, with 6 ports capable of handling container loading and unloading services, of which 3 are in Can Tho City. According to Decision No. 1012/QD-TTg dated July 3, 2015, of the Prime Minister approving the master plan for the development of the logistics center system nationwide until 2020 and orientation to 2030, two class 2 logistics centers will be operational in the Mekong Delta (MD). Among them, one logistics center will have a minimum scale of 30ha by 2020 and develop to 70ha by 2030, serving Can Tho City and the provinces of Hau Giang, Kien Giang, An Giang, Soc Trang, Tra Vinh, and Ca Mau. In the context of the Fourth Industrial Revolution, the development of green logistics has become an important factor for cities to achieve sustainable development. Can Tho City, located in the MD, plays a central economic role in the region and has great potential for green logistics development due to its developed transportation system and favorable business environment. This also leads to increasingly serious pollution, rising CO2 emissions, and worsening climate change. Therefore, businesses should apply a green logistics model to reduce noise pollution, waste, and CO2 emissions, aiming for more rational business operations and energy use. The most innovative and anticipated trend in 2021 is green logistics due to climate change and increasing consumer environmental awareness (Thanh Thu, 2022). Therefore, developing green logistics in Can Tho City in the Fourth Industrial Revolution is necessary to find optimal solutions for logistics in Can Tho towards sustainability, environmental protection, and enhanced economic efficiency.

2. RESEARCH METHODS

2.1 Theoretical basis

Concept of logistics: To date, there is no unified concept of logistics. According to Article 233 of the Commercial Law 2005, Logistics is the activity of managing the flow of raw materials through warehousing, production of goods, and delivery to consumers according to customer requirements.

Green logistics: The term "green logistics" or similar terms such as "sustainable logistics," "sustainable green logistics," were first mentioned in the 1980s. Many organizations and researchers have put forward different concepts of green logistics from various approaches. According to Zheng and Zhang (2010), Green logistics is the implementation of management activities aimed at satisfying customer needs and social development goals, connecting green supply and demand, overcoming spatial and temporal obstacles to achieve efficiency in the supply of goods and services. Green logistics emphasizes efforts and measures to minimize the negative impact of logistics activities, thereby

achieving a sustainable balance among economic, social, and environmental goals (Sbihi & Eglese, 2010). In summary, there are many different concepts of green logistics, but generally, green logistics can be understood as logistics activities aimed at sustainable, environmentally friendly, and environmental protection goals, minimizing negative impacts on the environment.

Green Logistics Development: This refers to efforts to minimize negative impacts on the environment to ensure more sustainable development among environmental, economic, and social goals. According to Xiu and Chen (2012), green logistics development focuses on reducing environmental pollution, reducing resource consumption, and utilizing advanced technology for planning and implementing transportation, storage, packaging, loading, unloading, and other logistics activities.

2.2 Content of green logistics development

According to Le Anh Tuan (2013), green logistics development research basically focuses on the following areas:

- Reducing external transport volume: This is often the first issue mentioned in the process of green logistics development. Reducing transport volume will decrease the travel distance of transport vehicles, thereby helping to reduce fuel consumption and environmental pollution.

- Improving transport efficiency within the city: Upgrading the quality of the transport infrastructure system, shifting from road transport to waterway and railway. Using environmentally friendly or low-carbon emission vehicles and optimizing the operation of the transport system are important solutions for greening transport activities.

- Reverse logistics: Green logistics development cannot be achieved without developing reverse logistics, which includes two main activities: product recovery and reuse, and waste treatment. Reverse logistics is the process by which businesses retrieve returned products from customers, products requiring warranty or maintenance, or end-of-life products and packaging from final consumers. It also involves utilizing recycled materials, scraps, and by-products from the production process, and recovering scrap from packaging and transportation materials.

- Green logistics policies in corporate environmental strategy: First, Greening warehousing activities. Warehouses with environmentally friendly features such as using solar energy, natural light, appropriate area, thick walls and floors, or allowing on-site recycling will save energy, reduce noise, and minimize emissions to the environment. Additionally, choosing environmentally friendly equipment in warehouses and optimizing warehouse operations also reduces negative environmental impacts. Second, Greening packaging activities. Better product packaging along with reusable materials and optimally arranged pallets will significantly save costs by reducing material usage, increasing warehouse space utilization and transport vehicle capacity, and reducing the amount of packaging that needs to be disposed of. Inappropriate packaging can lead to product damage during transportation and cause packaging waste, increasing the amount of waste released into the environment. Third, Greening information systems. A perfect information system can increase the greening level of logistics activities by providing real-time information and

precisely and optimally controlling logistics activities such as packaging, storage, transportation, processing, distribution, loading and unloading, inventory management, etc., to comply with economic and environmental requirements, facilitating the provision of logistics services with environmental responsibility.

- Green supply chain: The main activities involve optimizing the supply network to minimize transportation costs, increasing the greenness of the supply chain by purchasing goods and raw materials from green suppliers, seeking cooperation methods between suppliers and customers to green supply activities, and effectively managing waste streams to achieve higher environmental efficiency.

2.3 Role of green logistics development for sustainable development

- Role of green logistics development for the economy: Green logistics development is an important issue for implementing a sustainable development strategy. The main mission of green logistics development is to achieve economic goals associated with environmental protection. The development of green logistics will promote the use of recyclable materials for packaging, replacing wooden pallets with plastic pallets (which can be reused or recycled), helping to reduce costs, save resources, and protect the environment.

- Role of green logistics development for the environment: Logistics is listed as one of the industries whose development has an adverse impact on the environment. Therefore, green logistics development plays a very important role; it helps respond to global climate change, maintain the balance of ecosystems, and reduce negative environmental impacts such as reducing CO_2 emissions, reducing noise pollution, etc. Besides, green logistics development also represents development in harmonious relationship with culture and available resources, accessing clean water sources, and effectively managing waste issues, contributing to environmental protection.

- Role of green logistics development for society: Green logistics develops rapidly and meets increasing living demands, especially the increase in green consumption. To achieve green consumption, green products must be produced in an environmentally friendly manner and delivered to consumers through green logistics services. Green logistics development contributes to reducing social costs such as costs for improving and restoring water sources, land, forests, etc., enhancing human health and quality of life.

2.4 Lessons from green logistics development in the world

- Lessons from green logistics development in Singapore: Singapore has focused on sustainable development activities and climate change mitigation. The trend of sustainable development in Singapore is rapid, from master planning to green logistics development and smart building construction, aiming to implement the Singapore Green Plan 2030.

+ Policies and Regulations: The Singapore Green Plan, launched in February 2021, includes 5 pillars: City in Nature: Creating green spaces with 200 hectares of land for nature parks and planting approximately 1 million trees by 2030. Energy Reset: Shifting to cleaner energy sources, with the goal that by 2030 all newly registered cars must be clean energy vehicles and phasing

out internal combustion engine vehicles by 2040. Sustainable Living: Reducing 30% of waste sent to landfills, promoting recycling and circularity of waste materials. Green Economy: Investing in carbon emission reduction and increasing energy efficiency, developing green finance, sustainable consulting, and risk management. Resilient Future: Developing climate change resilience and enhancing food security, with the goal of meeting 30% of Singapore's nutritional needs by 2030.

+ Infrastructure: Singapore is a leading country in smart port development. The port authority works closely with shipping lines to build a dense maritime transport network, with daily trips to most major ports worldwide. The country also researches unmanned autonomous guided vehicles and uses smart sensors to detect transport anomalies, such as predicting traffic congestion points. In the aviation sector, Singapore has an Airport Logistics Park for time-sensitive, cold, and perishable goods. Staff are regularly trained to update new technologies and handle different types of goods.

+ Logistics service providers and users: Many businesses in Singapore have adopted green and sustainable solutions. Singaporean logistics service providers are also highly environmentally conscious, using electric vehicles and smart solutions for last-mile delivery.

+ Customers and citizens: A climate change awareness survey by the Singaporean government showed that over 90% of citizens are well aware of climate change and 78.2% are willing to take action towards a low-carbon Singapore, even if it entails additional costs and inconvenience.

- Lessons from green logistics development in Japan: Japan is a prime example of green logistics development through infrastructure investment, strict regulations and policies, along with active cooperation from businesses and citizens.

+ Regulations and policies: As early as 1989, Japan proposed three goals related to green logistics development over a 10-year period, including: reducing nitrogen compound emission standards by 3-6%, reducing particulate matter emissions by 6%, and reducing sulfur content in gasoline by 10%. In 1992, the Japanese Government announced nitrogen dioxide limits for vehicles and only allowed the use of 5 types of trucks that met environmental standards. By 1993, businesses had to replace old vehicles with new ones complying with emission standards. The Japanese Government continuously updates and revises policies to promote an efficient distribution system. Two basic strategies include: (1) Rationalizing urban logistics services by building logistics centers near major cities and key transport hubs; (2) The Government directly directs the construction of logistics centers, imposes lower emission regulations for trucks, issues carbon emission control standards, ensures the implementation of green packaging, and encourages recycling.

+ Logistics infrastructure: Since the 1960s, Japan has built and developed a warehousing system around major cities and near key transportation points. In 1965, the Japanese government built four logistics centers in Kasai (East Tokyo), Hoping Island (South Tokyo), Oshima (West Tokyo), and Adachi (North Tokyo). Japan also focuses on improving its transportation system, upgrading waterway and maritime transport systems, reducing road traffic congestion, and developing a multimodal transport network connecting localities. The

Japanese Government has invested heavily in transport infrastructure, including railways, roads, aviation, and port systems. In particular, public-private partnership solutions have been effectively utilized in logistics infrastructure development, such as the Hoping Island logistics center, which cost 57.2 billion Japanese Yen to build, with 70% from national financial institutions, 20% from local banks, and 10% from businesses.

+ Logistics businesses: Japanese logistics businesses are highly conscious of green development. To limit global warming, air pollution, traffic congestion, and energy limitations, Japanese logistics businesses actively transform their transportation methods. They use railway routes with less environmental impact and enhance maritime transport, as well as apply multimodal transport.

+ Customers: Along with the government's strict regulatory system, Japanese organizations, local authorities, and citizens make great efforts to keep the environment clean. Messages about environmental protection responsibility are ubiquitous, strongly impacting public awareness. The Japanese public's consciousness of environmental hygiene is also reflected in their behavior on the streets. Many choose bicycles as their main mode of transport and carry paper bags with waste compartments whenever they go to work or out, sorting waste before putting it in bins. Many stores buy used household items for recycling and restoration before reselling them, contributing to limiting a large amount of waste released into the environment.

2.5 Research methods

This research was conducted using a qualitative research method. It primarily focused on the case study method, with Can Tho City as the specific case. Therefore, the main methods used were document analysis, consultation with logistics and supply chain experts and managers. Secondary data collected included legal documents from the Government, the General Statistics Office, research works, statistical data, and other relevant information sources. This data was systematized, analyzed, synthesized, evaluated, and correctly commented upon to form the basis for proposing solutions.

3. RESULTS AND DISCUSSION

3.1 Advantages for green logistics development in Can Tho City

Can Tho possesses significant geographical advantages as the center of the Mekong Delta region, a crucial gateway for road, waterway, and international airport traffic. The city is also a junction of many important waterway and road routes, connecting to Phnom Penh (Cambodia) via the Hau River (55 km across Can Tho) and two important national waterway axes leading to Ho Chi Minh City (Cai San and Xa No).

Can Tho City is currently focusing on reviewing and perfecting mechanisms, strongly improving the investment and business environment, and strengthening connections to attract investment. The People's Committee of Can Tho City issued Decision No. 328/QD-UBND dated February 2, 2018, approving the action plan to enhance competitiveness and develop Vietnam's logistics services until 2025 in Can Tho City. On December 25, 2021, the Can Tho Party Committee issued Scheme No. 06-DA/TU on the development of transport infrastructure and logistics in Can Tho City for the period 2021 - 2025 and orientation for 2026 - 2030, with the overall objective of "the city

promoting its role as a driving force for regional development and an important hub for intra-regional and international transport".

Regarding road transport: Can Tho has mobilized various capital sources to invest in transport infrastructure in a synchronous, efficient, and focused manner, thanks to which the local transport has seen positive changes. Many projects have been implemented, including the project to upgrade and expand the Southern Hau River National Highway, the section from IC3 intersection to Cai Cui port; the Can Tho Western Ring Road (connecting National Highway 91 and National Highway 61C); Alley 91 Road (section from Long Tuyen to Can Tho Western Ring Road); renovation and expansion of 5 key intersections on main urban arterial roads; Provincial Road 917; Provincial Road 918; Provincial Road 921; Provincial Road 923; Co Do Bridge; Tay Do Bridge; Kenh Ngang Bridge; upgrading and expanding National Highway 61C; Road connecting O Mon district with Thoi Lai district, Can Tho with Giong Rieng district (Kien Giang province).

Regarding expressways: The North-South Expressway East project; Ho Chi Minh City - Trung Luong connecting with Mekong Delta provinces; Chau Doc - Can Tho - Soc Trang Expressway construction investment project; Project connecting National Highway 91 and Long Xuyen bypass; Cao Lanh - Lo Te upgrade project and Lo Te - Rach Soi pavement upgrade project under the Western Expressway corridor.

Regarding railways: According to the railway network master plan for 2021-2030, with a vision to 2050, in addition to the North-South railway line. The Ho Chi Minh City - Can Tho high-speed railway project is proposed to be built before 2030 with an estimated cost of about 7 billion USD (163,800 billion VND). The starting point of the route is An Binh station (Binh Duong), and the end point is Cai Rang station.

Regarding inland waterways: The waterway network in the area has a total length of 1,157 km, of which approximately 619 km are capable of transporting vessels with a tonnage of 30 tons or more. River routes managed by districts include 40 routes with a total length of 405.05 km, ensuring operations for vessels with a tonnage of 15 - 60 tons.

Regarding maritime transport: The Ministry of Transport has initiated the project to complete the channel for large tonnage vessels entering the Hau River Phase II. The project to dredge and recover products from the Dinh An - Can Tho maritime channel is being implemented to ensure standard navigation for vessels with a tonnage of 10,000 tons or more entering and leaving Can Tho ports.

Regarding aviation: The Can Tho International Airport is being fully developed according to the master plan, expanding its area to approximately 300 ha to build an additional airport area and a runway, with a capacity of 15 million passengers/year.

Regarding logistics centers: The city is calling for investment in the construction of a Class II regional logistics center in Can Tho City with a scale of 242.2ha. The functional area will connect with aviation, Cai Cui port, Tan Cang Thot Not port, and a center located in districts/communes, aiming to effectively exploit functional areas, in line with development planning orientation.

3.2 Difficulties in green logistics development in Can Tho City

Currently, logistics activities in Can Tho City and the MD region in general are only in the early stages of development. The transport infrastructure has not met the requirements for synchronous and modern development. Some important transport infrastructure projects have not yet been invested in and constructed according to the master plan. Can Tho still lacks regional seaport and airport logistics centers; traffic congestion has not been overcome on some main roads and key intersections.

Regarding logistics services, according to a report by the Can Tho Department of Industry and Trade, full-package logistics service companies in the area have generally not yet developed. Most logistics services related to production, trade, and services are carried out individually, lacking connectivity, thus not making good use of local resources and potential advantages. Outsourced logistics service providers also lack close connections among different modes of transport, between transport and warehousing, and other logistics activities.

The transport infrastructure system connecting provinces and cities to Can Tho City is generally still limited and weak. To date, there is still no expressway in the city (the East-West expressway axis Can Tho - Ca Mau was started at the end of 2022 but is expected to be completed by 2026). The horizontal expressway axis connecting Chau Doc - Can Tho - Hau Giang - Tran De (the section passing through Can Tho is 37 km out of a total of 183 km) is expected to be completed by 2026. Many bridges over rivers and canals have low clearances. Road bridges have low load limits, not ensuring freight transport by container trucks. Many types of import and export goods from the region have to be transshipped through ports in the Southeast region, generally affecting the competitiveness of goods.

Regarding waterways: Can Tho City currently has 02 large port clusters, Can Tho Seaport and Tan Cang Thot Not Port, capable of receiving vessels with a tonnage of 10,000 to 20,000 tons. However, they are limited by the Hau River channel, so they have not been fully utilized and face difficulties due to the natural bottom elevation of the Tieu - Tien River mouth, Dinh An, Tran De - Hau River, Bo De - Cai Lon River mouth, and many river mouths only allow sea vessels of 1,000 - 2,000 WT full load and 3,000 - 5,000 WT reduced load.

3.3 Solutions to promote green logistics development in Can Tho City

Green logistics development is heavily influenced by state mechanisms, policies, and laws; the city's transport infrastructure; the level of information technology development; the demand for green logistics services; the scale and market share of logistics businesses in the area; and logistics human resources. To develop green logistics towards sustainable development, a synchronous implementation of several solution groups is needed:

Developing green infrastructure: The city needs to invest in building green ports with smart management systems, minimizing emissions, and using renewable energy. Develop public transport systems and green transport, encouraging the use of electric vehicles and low-emission transport means.

- Greening transport activities: Upgrading and replacing current transport vehicles with new trucks with low emission levels will significantly contribute to pollution reduction. Upgrading

waterway transport exploitation means and investing in transport infrastructure, encouraging the construction of large tonnage vessels. Attracting investment in facilities for new construction and repair of waterway vehicles, while developing a high-quality, rationally structured fleet, minimizing environmental pollution and saving energy. Improving the quality of training and developing human resources in the field of waterway transport. Upgrading and expanding the airport to international standards, implementing rapid customs clearance, and expanding parking areas for receiving and dispatching goods. Using clean and efficient energy sources, maximizing the replacement of transport by means with high CO_2 emissions. Applying multimodal transport not only helps reduce pollution but also enhances logistics efficiency, contributing to sustainable development.

- Applying Industry 4.0 technologies in logistics: Using IoT to monitor and manage the supply chain, optimizing operational processes, and minimizing waste. Applying artificial intelligence (AI) in demand forecasting and inventory management, helping to reduce costs and environmental impact. Using blockchain to enhance transparency and traceability in the supply chain, ensuring sustainability and social responsibility.

- Greening warehousing activities: The planning of the warehousing system needs to be appropriate to minimize transport distances and save fuel. Warehouses should be located close to final consumers and connected to roads, waterways, and airports, facilitating faster goods transport and reducing emissions to the environment. Warehouses need to be designed to ensure safety and proper preservation of goods, meeting requirements for energy use and environmental protection, using environmentally friendly materials and technologies. Applying information technology to coordinate and manage warehouses helps optimize storage and handling processes. Warehouses should be located near transport hubs and industrial zones to shorten the time for goods collection before transportation to final consumers. This not only reduces transport time but also reduces fuel consumption and emissions to the environment.

- Greening reverse logistics activities: Raising awareness about reverse logistics is essential. Training management teams at all levels and in all sectors, especially within businesses, about the role and benefits of reverse logistics will facilitate the implementation and development of these activities. This will not only help businesses solve input and output problems but also make production and business processes more environmentally friendly. Businesses need to publicly and transparently provide information on production technology, product quality, and environmentally friendly packaging. Raising customer awareness about the importance of environmental protection through the use of green products and services is an important step.

- Greening logistics activities within enterprises: Employees in the logistics department need to be trained to have knowledge about reducing energy consumption. This includes activities such as moving products into warehouses, recycling packaging, and transporting goods within the warehouse. Businesses need to reduce the use of forklifts and double handling to optimize energy and fuel. The distribution process needs to be carried out

through multiple modes of transport such as road, rail, air, and waterway to increase efficiency and minimize environmental impact. Using technology to track metrics such as vehicle running time, fuel levels, and emissions. This helps businesses closely control their green logistics efforts, thereby proposing more effective improvement measures.

4. CONCLUSION

Currently, green logistics development is not only a global trend to address environmental issues alongside economic development goals, but also includes regulations and commitments with organizations that Vietnam is a part of that have environmental obligations. Developing green logistics in Can Tho City in the context of the Fourth Industrial Revolution is a necessary direction to achieve sustainable development. Applying solutions such as developing green infrastructure, greening transport activities, applying Industry 4.0 technologies in logistics, greening warehousing activities, greening reverse logistics activities, and greening logistics activities within enterprises will not only help minimize environmental impact but also enhance the city's economic efficiency and competitiveness. The government and businesses need to cooperate closely and implement appropriate support policies to promote the development of green logistics in Can Tho City.

REFERENCES

Beškovnik, B., & Jakomin, L. (2010). Challenges of green logistics in Southeast Europe. *Promet-Traffic&Transportation*, *22*(2), 147-155.

Delfmann, W., Ten Hompel, M., Kersten, W., Schmidt, T., & Stölzle, W. (2018). Logistics as a science: Central research questions in the era of the fourth industrial revolution. *Logistics Research*, *11*(9), 1-13.

Le Anh Tuan (2013). Some issues on green logistics. *International Conference: Sustainable Development of Vietnam's Logistics System.* Labor and Social Publishing House, Hanoi.

Ministry of Industry and Trade of Vietnam. (2021). *Logistics activities make important contributions to export growth.* Retrieved from: https://moit.gov.vn/bao-ve-nen-tang-tu-tuong-cua-dang/hoat-dong-logistics-dong-gop-quan-trong-cho-tang-truong-xuat-khau.html.

Sbihi, A., & Eglese, R. W. (2010). Combinatorial optimization and green logistics. *Annals of Operations Research*, *175*, 159-175.

Thanh Thu (2022). *Global green logistics market to exceed 1481 billion USD.* Retrieved from: https://vnexpress.net/quy-mo-thi-truong-logistics-xanh-se-vuot-1481-ty-usd-4508528.html.

Xiu, G., & Chen, X. (2012). Research on Green Logistics Development at Home and Abroad. *J. Comput., 7*(11), 2765-2772.

Zheng, L., & Zhang, J. (2010). Research on green logistics system based on circular economy. *Asian Social Science*, *6*(11), 116.